

## LOCAL WISDOM AND CONSERVATION STATUS OF TOR THAI MAHSEER FISH (*TOR TAMBROIDES* BLKR) IN THE BATANG HALUAN RIVER, WEST SUMATRA, INDONESIA

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### Abstract

*Tor thai mahseer fish (*Tor tambroides* Blkr) is an endangered species due to overfishing and their habitat destruction. Some rivers in the hilly area of Sumatra are their habitats and become a conservation area. This study aims to determine the status of the fish habitat, conservation program, analyzing local wisdom in conservation as well as an economic resource for the local community. Conducted by a survey method in the conservation area in Batang Haluan River, West Sumatra, Indonesia. Parameters measured included water quality, physical character of conservation areas and descriptions of local wisdom and the protected area management. The area was divided into; core zone, sustainable use zone and use zone. The zones were established in 1856 (core zone), gradually from 1925 to 1970 (sustainable use zone) and in 1925 (use zone). This conservation activity has been running well, involved religious scholars, traditional and community leaders and the local government. Harvesting of tor thai mahseer fish have become cultural and tourism events and have a positive impact to social, economic and environmental benefits. The conservation has become part of local wisdom, fostered the values of kinship, togetherness, the spirit of mutual cooperation and the establishment of friendly relationships.*

**Keywords:** Local wisdom; River protected area; Community economic empowerment; Fish conservation; Sumatran mahseer

### Introduction

Tor thai mahseer fish (also called Sumatran mahseer, Malayan mahseer, tambra fish) is included in the family of Cyprinidae, where the number worldwide reaches 20 species, while in Indonesia there are 4 species. Tor fish found in Indonesia are *Tor tambroides* Blkr., *T. tambra* (CV), *T. douronensis* (CV), and *T. soro* (CV). In the IUCN, the tor fish species is included in "data deficient" category, a species with insufficient data regarding their conservation, distribution or number. Mahseer fish (*Tor* spp) become worldwide concern species due to its status, opportunities and challenges for conservation [1]. Some authors [2, 3] described that the morphometric of *Tor tambroides* Blkr as follows; a compressed body shape (torpedo), terminal mouth position fish with a distinctive mouth and lip shape with a pendulous and protruding fold

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of skin, a convex snout shape and has two pairs of tentacles on the upper jaw [4]. There are 353 - 423 pieces of cycloid scales and have a lot of carotenoid pigments which give them a light and white, yellowish or golden color and their dorsal parts are dark. The number of scales along the lateral line is 23-25 pieces.

IUCN (International Union for Conservation of Nature and Natural Resources Red List Status, 2015) categorizes mahseer tor thai fish into threatened species [5]. Furthermore, the world's rare organism trade agency, CITES (Convention on International Trade in Endangered Species) of Wild Fauna and Flora in Indonesia, has not yet determined the status of the tor fish trade because it is still in the evaluation process [6].

The demand for this fish continues to increase, even though the price is relatively expensive. Therefore, its exploitation in nature continues to increase and results in an increasingly limited population in its natural habitat. On the other hand, the cultivation aspect has not been successful and has not even been widely researched [7]. In river waters in West Sumatra, especially in the Batang Haluan River, the conservation of tor thai mahseer fish has been carried out for a long time. This study aims to determine the status of the habitat and conservation of the fish, as well as to analyze the local wisdom practised in conservation as well as an economic resource for the surrounding local community in around conservation area of Sungai Batang Haluan, West Sumatera, Indonesia.

## Materials and Methods

### *Methodology and data collection*

This research was conducted from August 2019 - February 2020, Pasaman District, West Pasaman Regency, Province of West Sumatra, Indonesia by using a survey method. Measurement of the characteristic habitat of the conservation area, water quality and community socio-economic data were carried out. Data on physical characteristics and measured water quality include altitude above sea level, sampling coordinates, river depth, brightness, flow velocity, temperature, pH, dissolved oxygen, sulfate, phosphate, nitrate and riverbed substrate type. Meanwhile, community socio-economic data were collected using questionnaires and in-depth interviews with various stakeholders to obtain relative incidence, distribution and relationship between variables, sociology and culture.

Data collection on the characteristics of the Batang Haluan River waters was carried out in 5 sample areas covering one area in the core zone, three areas in the zone of sustainable use, and one area in the use zone. Station 1 was located in the utilization zone, stations 2, 4 and 5 were located in the restricted use zone. While station 3 was in the core zone or a full protected area. Data on fish production and value of fish production in the sustainable use zone was carried out through interviews with the community, traditional and religious leaders involved in conservation management in each village. The survey method in the field was dominated by participant observation and semi-structured interviews. To determine the production value, interviews were conducted with fish traders who bought the fish catch during the "opening of the river basin" in the use zone. To find out the progress of the conservation status, an in-depth interview was conducted with Syeh Mustofa Kamal, who is the sixth generation of the leadership of the Lubuk Landua Mosque, the oldest mosque in the area. Interviews were also conducted with formal leaders such as village heads, sub-district heads and heads of the fisheries service. Apart from interviews, supporting data was collected such as documents, reports and other publications.

**Results**

***Batang Haluan River general condition***

Batang Haluan River is located in West Pasaman Regency, West Sumatra Province, Indonesia. The upstream of this river flows from Mount Talamau. Upstream, along the river is covered with forest and shrubs. Furthermore, downstream is a plantation area and rice fields and 5 km before the estuary is a residential area. The length of this river is 15.9km and empties into the Batang Kapau River. Furthermore, the Batang Kapau River empties into the West Coast of Sumatra.

The water quality data revealed that this river is still normal and had not been polluted. The depth of the river ranged from 0.3-1.2m, very clear, the current speed ranged from 0.2-0.4 m/s, and the temperature ranges from 22-28°C with rocky riverbed, gravel and sand. While the chemical parameters that were measured included pH = 7.0-7.3, dissolved oxygen (6.3-7.1mg/L), sulfates (3.6-20.2mg/L), phosphates (0.02-2.0mg/L) and nitrates (1.6-2.0mg/L). More detailed data are presented in Table 1. In general, the rivers that empty into the West Coast of Sumatra have relatively the same geomorphological characteristics as the rivers in the Wallacea and Sahul exposure, namely classified as narrow, small, short, low sinuosity, low order and steep. Rivers with a depth of 0.3-0.7m are called shallow waters, and rivers with a depth of 0.8-1.2m are called deep waters, waters with a depth of above 0.8m are called river basins.

**Table 1.** Physical parameters and water quality of the conservation area in Batang Haluan River

No.	Water Quality and Parameters	Station 1	Station 2	Station 3	Station 4	Station 5
1	Altitude (m)	360	310	250	150	70
2	Coordinate	E99°54'12.92	E99°53'26.61	E99°53'15.65	E99°52'51.13	E99°51'23.91
3	Depth (m)	0.3-0.7	0.3-0.9	0.5-1.0	0.5-1.1	0.8-1.2
4	Brightness (m)	0.8	1.0	1.0	1.1	1.2
5	Current speed (m/s)	0.2-0.4	0.3-0.5	0.4-0.8	0.4-0.9	0.4-0.8
6	Temperature (°C)	22	24	24	25	28
7	pH	7.2	7.3	7.1	7	7
8	Dissolved oxygen (mg/L)	6.8	6.7	7.1	7.0	6.3
9	Dissolved sulfate (mg/L)	3.6	5.2	9.7	14.7	20.2
10	Dissolved phosphate (mg/L)	0.02	0.02	0.04	0.06	0.67
11	Dissolved nitrate (mg/L)	1.6	1.6	1.8	2.1	2
12	Riverbed substrate	Rocks, gravel and sand	Rocks, gravel and sand	Rocks, gravel and sand	Rocks, gravel and sand	Rocks, gravel and sand

The substrate type of riverbed in the upstream area was dominated by large stones with a diameter of more than 20cm and gravel, and the lower the size of the stones is getting smaller, followed by gravel and sand. The chemical parameters of water quality indicate that these waters are relatively fertile and have high levels of phosphate and nitrate [8, 9]. Phosphate and nitrate are nutrients that are important for the growth and metabolism of phytoplankton which are indicators to evaluate the quality and level of fertility in waters. The brightness and current speed of these waters are also very supportive so that this river can become a habitat for tor thai mahseer fish because the original habitat of fish is generally in the upstream part of the river in hilly areas with clear water and strong currents [10].

***Tor thai mahseer fish conservation area***

Communities along the Batang Haluan River, especially in Lubuk Landua Village, have established the conservation of tor thai mahseer fish since 1856. This determination was carried out through customary density (informal leader of every ethnic group and religious scholars)

and had been adhered to from generation to generation. This conservation area is divided into 3 zones, namely the core zone, the sustainable use zone and the use zone. In general, the waters of the Batang Haluan River have 3 conservation statuses, namely a core zone of 100 meters long, a sustainable use zone of 11,200m and a use zone of 4,700m. For more details, the percentage of each zone can be seen in Table 2.

**Table 2.** Zonation of the conservation area in Batang Haluan River

No	Zone	Long (m)	Percentage (%)
1	Core zone	100	0.629
2	Zone of continuous use	11,100	69.812
3	Use zone	4,700	29.559
	Total	15,900	100.00

### *Core zone*

It is a full protected area where the fish in this zone cannot be exploited at all. The waters of the Batang Haluan River have a core zone of 2,000m<sup>2</sup> with a length of 100m and a width of 20m. The core zone can be a source of germplasm and areas for spawning, nursery and fish habitat. Has a unique characteristic as a source of germplasm for conservation areas. This zone can also support effective fisheries management and ensure the natural bio-economic processes take place.

On the riverbank in the core zone area, there is an old mosque which was founded in 1854 by an Islamic figures and community leaders, Sheikh Maulana Muhammad Basyir. Administratively, this mosque is included in Lubuk Landua Village. At this time the leader of this mosque is the sixth generation of Syeh Lubuk Landua, his name is Syekh Mustofa Kamal. Based on Syekh Mustofa Kamal's interview, since 1856, fishing has been prohibited in 100 meters of the river next to the mosque. The prohibition is aimed to let the tor thai mahseer fish in these waters to eat plankton and other aquatic organisms so that the waters will be clean and clear. This clean water is used by the community to worship at the mosque.

### *Sustainable use zones*

The sustainable use zone area was established in stages starting in 1925 in the upstream area and ending in the downstream in 1970. This zone was established jointly by religious leaders, traditional leaders, community leaders and youth. The sustainable use zone is intended as a water area where fishing activities are carried out selectively with several limitations, such as restrictions on fishing time. This zone has a length of 11,200m tracing the river, which is 2km up stream above the core zone and 9.2km down stream below the core zone.

Communities around the Batang Haluan River call the sustainable use zone as a "prohibited zone" because fishing is prohibited outside the stipulated time. Fishing is only permitted at a predetermined time with restrictions on the number and size of fishing gear used. Fishing time is limited to a maximum of 4 days a year, usually after Islamic holidays, such as Eid Al-Fitr and Eid Al-Adha. Likewise, the fishing gear used is environmentally friendly fishing gear such as gill nets, nets, scoops and traps. The purpose of this limitation is so that the conservation efforts carried out can be sustainable. A sustainable fishery is one way to produce fish which is done in such a way that it can be sustainable [11]. Conducted by considering ecological health, minimizing side effects that disrupt the diversity, structure and function of ecosystems, and managed and operated fairly and responsibly, in accordance with local, national and international laws and regulations to meet the needs of present and future generations.

### *Use zone*

The conservation area for the use zone was determined at the same time as the establishment of the sustainable use zone in 1925. This zone is a zone that is free to catch at any time, but the fishing gear used must be environmentally friendly, such as fishing rods and

fishing gear used in the sustainable use zone. This zone is located in the upper reaches of the Batang Haluan River with a length of 4.7km. Access to reach this zone is relatively difficult because there are no roads, and it is far from residential areas. Around this area is still covered by forest and shrubs so that people rarely catch fish. This situation makes this area a protected area and plays a very important role for conservation purposes globally. This area is also useful for protecting and enhancing biodiversity and ecosystem services.

#### ***Local wisdom and conservation area management***

Conservation of fish habitat in the Batang Haluan River was carried out in stages starting from 1925 to 1970. This long duration of time due to a gradual introduction to the community, so that they really understand and appreciate the importance of conservation for their lives. Some authors [11, 12] mentioned that the notion of socialization is a process that helps people learn and adapt to how to live and how their group thinks, so that they can play a role and function in the group. Furthermore, socialization is the process of studying norms, values, roles, and all other requirements needed to enable effective participation in social life [13, 14].

The participation of local communities in conservation is very crucial, from implementation to monitoring. The communities involved in implementing this conservation consist of religious scholars, traditional leaders, community leaders [15, 16], and the government. The government involvement in conservation was carried out by stating sustainable use zones in several villages in this area through a local government decree. This decree was issued in 2014 and is still valid today. The decree is a formal recognition of the conservation area for fish resources in a limited use zone with collaborative management [17]. Co-management is an approach to fisheries resource management that plays a major role in community participation [18, 19]. This co-management is facilitated by the government and other stakeholders in managing its resources [20-22].

The conservation of tor thai mahseer fish in this area involves active community participation, starting from obeying all the rules and regulations that have been made and participating in protecting these fishery resources from human disturbance. Community involvement in implementing conservation has been going on since the designation of these conservation areas. Until now, there have been almost no violations of conservation activities carried out in the waters of the Batang Haluan River. The implementation of conservation is going well because of the regulations made by the community that rooted their culture (local wisdom) in carrying out conservation activities.

The regulations in the core zone of fish habitat in the Batang Haluan River were first set by a spiritual leader Buya Syekh Basyir together with the community. In these regulations, they vow that for those who do damage or catch fish in the core zone, their life will be miserable, their stomachs will swell and can even lead to death. Until now, these regulations are still being obeyed and no one has ever violated them. A regulation is a procedure carried out by the community to discipline and harmonize with the needs of the community. Regulations in conservation management are informal and unwritten but are obeyed by the entire community. Informal laws that apply in society are obeyed by the community because these laws really live in the conscience of citizens [23, 24]. This is reflected in their patterns of action in accordance with their customs and socio-cultural patterns which are not contrary to national law and constitute the existence of customary law in national law [25, 26].

Regulations in the sustainable use zone are carried out with the agreement of community leaders, religious leaders, and customary leaders from the villages that are included in the conservation area. Each village has relatively the same rules and in general. The regulation states that fishing is prohibited in conservation areas other than on days that have been mutually agreed upon. It is also prohibited to damage the aquatic environment such as taking river stones and sand around the waters. For those who violate it, they will get economic and social sanctions. Economic sanctions, for example, pay a certain amount of money to the customary leader who functions as the person in charge. Social sanctions, for example, are ostracized by

society. According to community information, during the last 10 years there were only two violations. Various practices of local wisdom and ancestral culture are still adhered to by the Indonesian people. This is because the purpose of protecting natural resources and the environment is in accordance with religious teachings and customary law. Obedience to regulations in carrying out conservation has provided benefits to the community and the environment [27, 28].

In the use zone, the regulations are also determined based on the agreement of community leaders, religious leaders, and customary leaders. In this zone there is no time limit for fishing. However, the fishing gear used must be environmentally friendly, such as fishing rods, gill nets, nets, scoops and fish traps.

#### ***Utilization of the tor thai mahseer fish conservation area***

The event of catching fish together in the conservation area of tor thai mahseer fish in the Batang Haluan River has become a cultural and tourist event that the community has been waiting for. They call it "membuka lubang or opening the river basin". This event has been a tradition for a long time and is followed by local people, visitors and other communities. This event is usually held after Islamic holidays, such as Eid Al-Fitr and Eid Al-Adha. Economically, this sustainable use zone provides benefits to increase the income and welfare of the local community. One of them is because during these activities local tourists who come, both local residents and those who come from outside the region.

This event is organized by a committee formed from and by the local community. According to the event organizing committee, the big river basin can be attended by more than 2,000 people, while the medium river basin opening event can be attended by around 1,000 people. Meanwhile, the small river basin can be followed by around 500 people. The number of pits that are opened annually is approximately 34 river basins. It is estimated that each river basin has an average attendance of 1,000 people.

The income obtained from the opening of the tor thai mahseer fish conservation area comes from the sale of entrance tickets for the event and the sales of fish catches by the committee. Every visitor who will catch fish is required to buy a ticket for IDR 50,000 per person. After that they are allowed to catch fish using the specified environmentally friendly fishing gear (gill nets, nets, scoops and fish traps). The fish catches of the participants will usually be consumed alone or distributed to neighbors and family members. Meanwhile, the catch from the organizing committee is sold to fish traders. According to traders, they buy fish at an average price of IDR 60,000 per kg and sell them at IDR 80,000 - IDR 150,000 per kg depending on size. The bigger the fish size, the higher the price. It is a tradition that the number of traders who buy fish in this area is 5 people per river basin. Each basin already has its own subscription. In addition, during the event the local community sold a variety of foods, drinks and necessities needed by visitors. This adds to the economic cycle of the local community.

The results of interviews with traders stated that during the last 5 years the number of fish they bought each year was relatively the same. This situation is presumably due to restrictions on fishing gear and fishing time. In addition, the maintained ecosystem and aquatic environment also support the use of sustainable fisheries. It was reported that use of sustainable fisheries is maintaining the sustainability of fish stock or biomass resources so that their utilization does not exceed their carrying capacity, as well as increasing the capacity and quality of the ecosystem. This is an example of how business development, including fisheries sector can synergize with the conservation function [29, 30].

Conservation benefits can be seen from various aspects, such as social, economic and environmental [31]. Other researchers [32] mentioned that the benefits of conservation include preservation of natural conditions and the environment. This condition can prevent disasters due to natural changes, avoid living things from extinction and create environmental balance and be able to contribute to science and tourism. Conservation of tor thai mahseer fish in the Batang Haluan River provides important benefits for the surrounding community. The social benefits of

the conservation area in this area are that it can increase and foster the values of kinship, togetherness, the spirit of mutual cooperation and the establishment of friendly relationships between villagers, visitors and tourists who come during the activity. Furthermore others [33] stated that the number of tourists visiting an area will open business opportunities for the surrounding community to carry out activities by providing various kinds of tourist needs while in the area. This opportunity is utilized by the community by offering various services or goods needed to attract visiting tourists. The increasing demand for services and goods needed by tourists has an impact on increasing the income or income of people in the area.

The revenue from ticket sales and the revenue from the committee's fish catches is different for each river basin, depending on the size. A small river basin has an area of <1000m<sup>2</sup>, a medium hole has an area of 1000-2000m<sup>2</sup>, and a large basin has an area of >2000m<sup>2</sup>. The estimated amount of money obtained from the sale of fishing event tickets and revenue from fish sales in 2019 can be seen in Tables 3 and 4.

**Table 3.** Revenue sales of admission tickets for opening the river basin of the tor thai mahseer fish conservation area in the Batang Haluan River in 2019

No.	Size of river basin	Total of river basin	Number of tickets sold (pcs)	Ticket price (IDR)	Total of ticket revenue (IDR)
1	Large	5	1,000	50,000	50.000.000
2	Medium	19	1,900	50,000	95.000.000
3	Small	11	550	50,000	27.500.000
Total					172.500.000

**Table 4.** Revenue sales of fish caught by the committee tor thai mahseer in the Batang Haluan River conservation area in 2019

No.	Size of river basin	Total of river basin	Total catch (Kg)	Price/Kg (IDR)	Total of ticket revenue (IDR)
1	Large	5	1,250	60,000	75.000.000
2	Medium	19	2,850	60,000	171.000.000
3	Small	11	660	60,000	39.600.000
Total					285.600.000

From Table 3 it can be said that the Batang Haluan River conservation area has provided economic benefits to the surrounding community. The implementation of conservation can provide benefits to humanity, increase people's welfare, and develop sustainable livelihoods for citizens, as well as increase the sustainability of fish resources. Furthermore, the benefits of fish conservation for the environment can be seen from various aspects such as aquatic ecosystems, restoration and fish stocks [34, 35]. Some authors [36] even stated that fish conservation can have a positive effect on the state of the ecosystem as indicated by the large abundance of fish and high diversity of fish species, starting from the species of small fish to big fish in these waters. Fish conservation provides direct benefits by contributing to the restoration of overfishing stocks [37, 38].

### Conclusions

The conservation area for tor thai mahseer fish in the Batang Haluan River in the core zone has been started since 1856, while in the advanced use zone it was implemented in stages starting from 1925 to 1970. The conserved area covers 70.41% of the Batang Haluan River. Until now, this conservation status is still well maintained and obeyed by the whole community. Conservation management is carried out by applying several local wisdom values and norms. This conservation activity involves community participation such as religious scholars, traditional leaders, community leaders, youth groups facilitated by the government.

Conservation activities in this area provided social, economic and environmental benefits. Socially, conservation has fostered the values of kinship, togetherness, the spirit of mutual cooperation and the establishment of friendly relationships between villagers, visitors and tourists who come during river basin fishing events in the sustainable use zone. Economically, conservation has provided benefits to the income and welfare of the community through various activities during the event.

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